

VI. *Observations on an astringent vegetable substance from China.*By William Thomas Brande, *Esq. Sec. R.S.*

Read December 12, 1816.

THE substance described in the following pages was put into my hands for examination by the President, who received it from China, with some others employed in the art of dying; and although the small quantity hitherto sent to this country, has not enabled me to extend my experiments upon its useful applications as far as I could have wished, I trust that its chemical history will be deemed of sufficient importance to interest the Royal Society, and to prove its usefulness as an article of commerce, provided it can be obtained abundantly, and at a cheap rate, which I think admits of little doubt.

The parcel containing this substance was marked "Oong poey," *a species of galls used in dying black.* They have the appearance of irregular vesicles, the coats of which are about one-tenth of an inch thick, of a grey and reddish colour, smooth, and very brittle, and containing in their interior a brown powder, among which insects may be discerned by the microscope. Some of these vesicles were adhering to twigs of the tree, and they appear to be formed upon the younger branches.

They have a more austere and purely astringent taste than any other of the vegetable substances of that class I have met with, and they produce, when thrown into any of the red salts of iron, a pure black tint.

Of the source of these bodies nothing is said, but on referring to DU HALDE, (description de l' Empire de la Chine, &c. folio, Paris 1735; page 496.) I found an account of a Chinese drug, entitled *ou poey tse*, and which appears to be the substance in question. Their formation is ascribed to small insects, and the general description of their exterior characters agrees nearly with that I have given: they vary in size, from a small gall nut to a large chesnut. M. GEOFFROY, in the Memoires de l' Académie Royale des Sciences, 1724, has published a Paper entitled, "Observations sur les vessies qui viennent aux Ormes, et sur une sorte d' excroissance à peu près pareille qui nous est apportée de la Chine." He conceives that the excrescences occasionally formed upon the elm are similar to those from China, but does not identify the two by any experiments; and indeed it would appear, from the account given by DU HALDE, that the *ou poey tse* are obtained from a very different tree. These Chinese galls are likewise employed in medicine, and a full account of their various preparations are annexed to DU HALDE's observations.

My first experiments were directed towards ascertaining the quantity of tannin which they contained, and which I have found considerably greater than that in any other vegetable astringent in common use.

One hundred grains of the Chinese galls, freed from extraneous matters, were reduced to a coarse powder, and infused in cold distilled water, till that fluid ceased to act upon the residuum. The infusion was of a very pale brown colour, and of a highly astringent flavour; it furnished a copious white precipitate with a solution of jelly, and became deep black upon the addition of the oxy-sulphate of iron. When

carefully evaporated to dryness, there remained upon the glass capsule 75 grains of a brown transparent substance, having a resinous fracture, a rough, astringent, and slightly sour taste, and which powerfully reddened litmus paper. It was quite soluble in cold water, and the solution had the same properties as the former, except that its colour was somewhat deeper. It was perfectly soluble in alcohol, (sp. gr., 820 at 60°), and its properties were not altered by repeated solution in water and evaporation.

It appears from these characters, that the substance in question contains tannin nearly free from extractive matter. Indeed, I am not aware that tannin exists in the same state of purity in any other vegetable product.

The residuum which had resisted the action of water weighed when dry 27 grains; it was digested in 2 ounces of alcohol, which acquired a slightly brown tint, and was rendered turbid by the addition of water. The substance that precipitated was fusible and inflammable, and had the other characters of resin. When heated it exhaled a very peculiar odour. There now remained 23 grains of a grey substance insoluble in boiling water and alcohol, and which when heated burned quietly away without residuum, and therefore possessed the characters of woody fibre.

During the preceding experiments, several circumstances occurred, which induced me to believe, that the aqueous solution, though remarkably free from extractive matter, contained a considerable proportion of gallic acid, I therefore endeavoured to ascertain the relative quantity of this acid contained in the brown residuum obtained from the watery infusion. For this purpose it was boiled in water with carbonate of barytes,

according to the process recommended by Sir H. DAVY, and the gallate of barytes was subsequently decomposed by dilute sulphuric acid; I found it, however, impossible to obtain the gallic acid in a free state, on account of the facility with which it was decomposed on attempting to evaporate the solution.

When lime water is added to the aqueous infusion of the galls, a copious insoluble precipitate is formed, consisting of tannin and lime, and a gallate of lime remains in solution, which is decomposed by oxalic acid. In this way I succeeded in procuring the gallic acid nearly pure.

I boiled some pure caustic lime in a strong infusion of the galls, and when cold, filtered the mixture: oxalic acid was added as long as it produced a precipitate in the filtered liquor, heat was applied, and after separating the oxalate of lime, a solution of nearly pure gallic acid was obtained.

I have failed in all these experiments in obtaining the gallic acid perfectly pure, but the Chinese galls appear to me to offer a most promising source of that acid in its pure state, and the gallates obtained by the processes above described, seem to be entirely free from extractive matter and to approach nearer to pure salts, than those which are procured from infusions of the common galls.

When the Chinese galls are exposed in a glass retort to the heat of an Argand lamp, a considerable quantity of gallic acid tainted by empyreumatic oil, rises into the neck of the vessel, and if the heat be continued, the water which is produced dissolves it, and carries it over into the receiver: during destructive distillation, therefore, a considerable portion of liquid gallic acid may be thus obtained.

One hundred grains of the galls in powder, were submitted

to the action of heat, gradually raised to redness, in a retort to which a proper apparatus was adopted for collecting the liquid and gaseous products. They afforded the following results.

	Grains.
Water tainted by empyreumatic oil, and holding gallic acid in solution	50
Gaseous compounds of charcoal with oxygen and hydrogen	10
Charcoal remaining in the retort, and affording traces of minute quantities of lime	38
	<hr/> 98

It appears from the foregoing experiments, that the substance existing in the Chinese galls which has the power of forming an insoluble white precipitate with animal jelly, and which has a purely astringent flavour, is also perfectly soluble in alcohol; hence it seems, that the assertion of many chemical writers concerning the insolubility of pure tannin in that menstruum is not correct. In this respect the tannin of the China galls resembles that obtained from catechu, the properties of which have been examined by Sir H. DAVY,* and it is probable, that the tannin described by BOUILLON LA GRANGE† as insoluble in alcohol, obtained from infusion of galls by carbonate of ammonia, was not pure.

The want of extractive matter in the China galls, would probably render them very unfit for the purposes of tanning, and I do not find from DU HALDE, that they are ever applied by the Chinese to that use. I found the leather produced by

* Phil. Trans. 1803.

† Annales de Chimie, Vol. 56.

their infusion extremely brittle when dried. The same circumstance however, namely, the absence of extractive principle, probably would materially contribute to their excellence as a source of the black dye, the intensity and perfection of which is, I conceive, often interfered with by the presence of extractive matter in the common gall nut and other vegetable astringents usually employed. These galls are likewise particularly proper for the production of writing ink, the tendency of which to become thick and mouldy seems principally to be derived from extractive matter.